

# Influence of Tropical Lower Stratospheric Cooling on Extreme Deep Convective Activity and Tropical Cyclones

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In previous studies we showed that stratospheric sudden warming (SSW) event can induce rapid cooling in the tropical stratosphere and impact on the tropical convective activity. Case studies on two large SSWs in January 2009 and January 2010, showed that convective activity increased along ascending branch of the Hadley circulation in the austral summer hemisphere. It is also found that frequency of the convective overshooting clouds, and the tropical cyclones (TCs) increased following the tropical stratospheric cooling. Detailed analysis on the relationship between the tropical stratospheric cooling and tropical cyclones are made for 2010 January case. In January 2010, TCs have been generated one after another over Indian Ocean, Maritime continent, and Pacific sectors following a eastward propagation of convective active center associated with the Madden-Julian Oscillation (MJO) until rapid cooling started in the tropical stratosphere in late January. Then, after that, MJO became stationary over the central Pacific and TCs developed or re-developed simultaneously over 3 different sectors: Southwest Indian Ocean, Australia, and central Pacific. TC does not form over the lands, however, extreme deep convective activity simultaneously enhanced with the TCs over African and South American continents. It is suggested that a decrease of static stability in the tropical tropopause layer (TTL) due to a cooling in the lower stratosphere, produced favorable condition for the development of extreme deep convection. The increase of extreme deep convection around 15° S latitudinal zone following the tropical stratospheric cooling can be characterized as a strengthening of deep ascending branch of the Hadley circulation connected to the Brewer-Dobson circulation.

Keywords: tropical cyclone, stratosphere, deep convection